ENGINEERING NEWS.

Tribune Building, New York City.
GEO. H. FROST, PROPRIETOR.

SATURDAY, JANUARY 22, 1881.

THE Joint Library Committee have approved the plans of J. L. Smithmeyer, architect, of Washington, for the proposed new Congressional Library Building, and have asked the Senate to ratify their action.

THE reclamation of waste lands is certainly one of the most profitable investments of capital, but few enterprises promise such colossal revenue as the Louisiana Land Reclamation Co. This company has the title to 200,000 acres of land, and has already reclaimed 13,000 acres. With sugar and cotton planting, they estimate their annual revenue some years hence at thirty million dollars.

FROM communications received we publish today an account of the Groveland Bridge disaster; the matter will undoubtedly be investigated when more detailed particulars will be forthcoming, and the bridge company will have an opportunity of giving their version of the case. That no attention was paid to the care of the bridge seems apparent from the newspaper comment, and, even after the warning by the passing horse-car, it was not deemed necessary to examine the structure, and so prevent an accident. The people of Haverhill are very greatly to blame for their careless neglect of so important a matter, especially when the bridge had for some time been considered "unsafe."

THE construction of railroads for strategic purposes has been actively pursued in France and Germany for several years past. France is especially active in railroad building in the Eastern departments. During the year the frontier lines from Frouard, *via* Pompei, to Nomény-sur-Saille, and from Conflans to Moyenore. Along the Northern frontiers several lines are now open. Canals and rivers have also shared the attention of military engineers. The Meuse has been canalized; the Saône and Moselle joined together to the Marne. The impulse which is given by military necessities, though more feverish than that of commercial requirements, is never so really great, yet the works of the great military engineers have not always lost their usefulness with the occasion which gave them birth.

MR. WM. H. WEBB, the steamship man, before the House Committee on Foreign Affairs, on the 18th, said that he regarded the Panama Canal as in conflict with the Monroe doctrine. Any canal across the isthmus should be under the absolute control of the American government. He believed that the Panama project had been got up by a set of adventurers, who would probably be the only ones to profit by it. He referred to the design so long entertained by the late Emperor of the French to gain a foothold in Central America, first by means of a ship-canal and afterward by the French expedition to Mexico, and said that the Panama Canal project was part of that scheme pressed by Napoleon's followers. Mr. Cornelius Vanderbilt had obtained a concession from the Nicaraguan government many years ago, and had endeavored to obtain European capital for the canal project, but had not succeeded, the ground of refusal on the part of the English capitalists being that such a canal would be a greater advantage to American commerce than to their own. He (Mr. Webb) had afterward obtained a like concession and had made a like effort, but, owing to bad faith on the part of Nicaragua through the interference of the French Emperor, the effort had failed. Mr. Michel Chevalier, one of the Emperor's favorites and whose co-operation Mr. Webb had endeavored to obtain, had refused it on the ground that if the canal was to be constructed it must be under French auspices and with American money. That showed how determined the French people had been to obtain control of a canal across the isthmus.

THE MEXICAN NATIONAL RAILWAY CO.

The grant under which this company is now operating is known as the Palmer and Sullivan, and was obtained from the Mexican government by Gen. William J. Palmer, President of the Denver & Rio Grande Railway. The proposed line will extend from the city of Mexico in a northwesterly direction through Toluca to Acámbaro, where it branches, one line going north through San Luis Potosi, Monterey, and thence to Laredo, on the Rio Grande River; the other through Morelia, passing on the north side of Lake Chapala, thence southwest through Colima to Manzanillo, on the Pacific Coast. Additional state grants have recently been obtained for branch roads from San Luis Potosi to Zacatecas, thence south to Lagos, and from Morelia to Patzcuaro. The entire road will be about fifteen hundred miles in length, the distance from the City of Mexico to Laredo being eight hundred miles.

The contract making the concession was executed Sept. 13, 1880, and it expressly stipulated that the plans of a specified portion of the road should be completed within fifteen days thereafter, and the surveys of the remainder begun within three months, and the entire road finished within eight years. In accordance with the terms of the grant the requisite plans were finished, and surveying parties were started both from the City of Mexico and from Laredo. These are now pushing rapidly forward and, it is expected, will soon finish the entire line.

The subsidy of the government of Mexico is $11,270 per mile upon the line to the Pacific, and $10,460 per mile upon the line to Laredo. The company is limited in its issue of bonds for construction purposes to $20,000 per mile.

On that portion of the road leading from the City of Mexico a force of three thousand men is now engaged. The principal work at present is a tunnel which is to be cut through the mountains some miles west of the city, and at an elevation of ten thousand feet. After piercing the mountain the road runs across a plateau, which is remarkably fertile and healthy, and then along the lower part of the Sierra range.

All the timber necessary for the construction of the road can be obtained along the line; and at localities near the City of Mexico, and also near Laredo mines, yielding a fine quality of bituminous coal, and in quantities amply sufficient for all purposes, have been found.

The road will be three feet gauge, laid with steel rails, weighing forty pounds per yard. About 20,000 tons of rails have already been contracted for, and 3,000 tons have been delivered at Vera Cruz, and will be immediately forwarded to the capital.

The Baldwin Locomotive Works, of Philadelphia, is now building eighteen engines of thirty and forty tons. Between three and four thousand freight cars have been contracted for, and will be shipped as soon as finished, to be used both on this road and the Denver & Rio Grande.

As only small portions of the routes have been surveyed but little can be said of the topography of the country, yet it is conceded that many difficulties will have to be overcome and that steep grades will be encountered, one of one hundred and seventy-five feet to the mile having been already surveyed.

Gen. William J. Palmer is president of the company; Mr. W. C. Wetherill is chief engineer, with headquarters in the City of Mexico. The New York offices of the company are at No. 15 Cortlandt street.

The importance of the road cannot be easily overestimated; it runs through a country extremely rich in tropical fruits, and covered with a heavy growth of valuable trees; a vast mineral wealth only awaits developing; the route, by connecting at Laredo with the great southwestern system, will form an almost direct line to the main central cities of the United States.

THE GROVELAND BRIDGE DISASTER.

While a heavy load of shingles, drawn by four horses, was crossing the above structure, Thursday, Jan. 13, the second span from the Groveland side gave way, letting team and driver into the river. Owing to the fact that the river was covered with ice, or to the manner in which the bridge gave way, or both, the team was not entirely immersed, or very seriously injured. At the time of visiting the wreck, the day after the accident occurred, the Haverhill end rested upon the pier, forming an inclined plane; the other end was nearly all submerged. The bridge is a bowstring girder, crossing the Merrimac at Groveland, Mass. The up-river arch was apparently broken very near the center, the ends of the pieces projecting through the ice. The other arch, or what could be seen of it, was twisted as if it had been wire. The character of the fracture seemed to indicate that the structure had been weak here for some little time at least, whether it gave way here first or not. The arch or bow is composed of two 7-inch channel irons, $\frac{1}{4}$ inch thick, and two plates $11\frac{1}{2}$ inches wide by $\frac{5}{16}$ inch thick. The fracture in one of the channel irons was covered by an old rust, as was the web in the other. One half of the lower plate was rusty, but apparently had not been so many days; the remainder of the fracture was new, not being oxidized at all. Some other broken portions were visible, including two of the braces uniting the two arches at the top. These are compound, of four pieces, converging into one at the ends. One end of these had been nearly broken for some time. There are four of these braces to each span.

The lower chords consist of two bars, 6 inches × 1 inch, and the flooring joists rest directly upon these—a doubtful expedient. There are thirteen vertical struts of a cruciform cross-section. The ties at the ends are about $1\frac{3}{16}$ inch in diameter, at the middle 1 inch in diameter. The counters are about 1 inch in diameter.

The strength of the bridge has been doubted for several years by many who have seen it, and certainly it does not impress one favorably. It seems to lack stiffness and vibrates considerably while heavy loads are passing over it.

The following article, taken from the Haverhill *Bulletin* of Jan. 14, may add to the above description:

"The disaster to the Groveland Bridge Thursday afternoon is the chief theme of conversation in this city, and at Groveland. It was certainly a very unfortunate affair. Thursday evening, when the cars went over from the stable at about 6:25 to take the Groveland passengers, a loud report was heard, as though some of the iron work had broken, and those who heard it were almost afraid to go over. It is possible that the two string pieces resting upon the pier where the break occurred were snapped as the cars passed along, but there was still strength enough in the rods passing up through the stringer into the arches above to hold the horse cars. But when the heavy load of lumber reached the span, the broken stringer gave way and the whole went down. This is evident from the fact that a con-

siderable portion of the span still rests upon the next pier, forming an inclined plane. The enormous weight of snow and ice resting upon the bridge hastened the disaster. A structure which cost $80,000, and upon which so much depended, should have had the best of care.

The bridge was completed and accepted by the County Commissioners on Wednesday, April 10, 1872. On that day the structure was tested in the presence of a large crowd of people, and the Newburyport *Herald*, of April 11 says: "The test was applied by placing 55,000 pounds, 27½ tons, on the center of each span, which was equal to 60 tons distributed. Fifteen tons were left standing upon the drawer. The deflection of arch on trial was three sixty-fourths of an inch. The raising of the draw occupies but five minutes. The test was highly satisfactory, and the bridge was accepted in due form.

"The ground was broken for this really elegant structure on the 29th of March, 1871. It rests upon six substantial granite piers. It is known as King's patent tubular bridge, from a new design invented by C. G. Force, of Cleveland, Ohio, Engineer of the King Bridge Company. The patentee of the bridge is Z. King, of Cleveland, Ohio, and the superintendent is Col. F. J. Coffin, of this city. The bridge consists of six spans, each span 125 ft.; the length of flooring, 804 ft.; width in clear, 36 ft.; draw, 48 ft. Its cost was $80,000, of which the county assumes twenty-seven sixtieths; Haverhill nineteen do.; Groveland eight do.; West Newbury six do. The saving in travel to Haverhill by this bridge is two miles.

"The structure should be immediately repaired, the bridge has been a great highway for travel, and the interruption is a very serious matter, especially to the hundred or more people who come every day to this city for work and business. Just at present, however, the passing over the ice is very good.

"There will doubtless be some difference of opinion as regards the matter of expense, but that should not delay the work of repairing a single day. The traveling public demand that energetic measures be at once taken to make necessary repairs and render the structure safe in the future."

The following more detailed description is from the *Railroad Gazette*, published about the date of the opening:

"The roadway is carried on each span by two wrought-iron bowstring trusses, placed about 25 ft. apart. The arch or bow has a box section of two vertical plates and two horizontal channel bars, so placed at the upper and lower edges of the plates as to bring the flanges outward. The plates are 13 in. × 5-16 in., the channel, 7½ in. × 2¼ in. × ⅜ in., rise of arch 11.75 ft.

"The bottom cord or tie is in each truss made of two flat bars, each 6 × 1 in., placed on edge and drawn down at the ends to 2 in. round rods, on which are cut threads passing through a nut at the back of a cast-iron skewback, which receives the heel of the arch. The bracing is made with verticals of cross iron, 4½ in. × 3½ in. × ⅜ in., and with two diagonals in every panel, of ¾ in. (?) round rods. These are all attached to the chords by screw ends, nuts, and cast-iron bearing blocks. The cross beams are of wood 4 in. × 16 in., spaced 2 ft. apart between centers, notched over and carried by the bottom cord. Four of these beams extend beyond the others, on each side, and carry a cross iron strut up to the arch. There are ¾ in. rods forming the diagonals of a double system of lateral bracing under the flooring. The latter is of 4 in. plank laid longitudinally. There are also 4 panels of lateral bracing carried by cast-iron standards above the arch."

THE PANAMA ENGINEERS.

The cable has reported the departure, on January 6, of the corps of engineers who are to conduct the work on the Panama Canal. We find, in the Paris papers of the 5th inst., a short account of the dinner which was offered them by the contractors, Messrs. Couvreux and Hersent, at the Hôtel Continental. The personnel comprises the following gentlemen: A. Reclus, already known for having surveyed the isthmus in conjunction with Messrs. Wyse and Verbrugghe, and who will be the chief representative for the canal company; Blanchet, who will be the representative of the contractors and superintendent of the works; Claude Cavenod, who is already known by his works at Cherbourg, and by his survey for the Trans-Saharian road, and Messrs. Harel and Roux, with 35 aids. M. de Lesseps made a little "speech" and told the gentlemen not to be uneasy about the climate; "only the cold is dangerous in warm countries. When an Arab is unwell, the phrase used is 'he has drunk cold.' You are leaving here forty, all told, but you have a perfect right to colonize—the ladies there are charming." An immense shout of laughter greeted this humorous allusion to non-professional enterprises.

CANAL CUTTING.

The discussion with regard to the comparative cheapness of the waterway and the railroad has never been satisfactorily closed. It is a great proof of the favor in which the "road that runs" is held, that there are so many new projects mooted both in this country and in Europe.

The North and the Baltic seas will, doubtless, be joined by a canal within a few years, and so will the Atlantic and the Mediterranean, between Bordeaux and Marseilles. The canals of the future, if the Panama be a success, will enter even more largely into the plans of the capitalist. Isthmuses will disappear—in so far as going round them is concerned—and the face of the world will be changed geographically.

CORRECTION.

"The Relative Efficiency of Propeller Wheels." Page 8, *ante*. The angle *A C O*, of the helix, in the first column, last line of fourth paragraph, should read, 17° 36′, instead of 11° 36′.

PERSONAL.

General manager P. E. Hall, of the Sioux City & Pacific Railroad, has issued the following orders at Cedar Rapids, Iowa, Jan. 15:

Mr. J. S. Wattles has been appointed superintendent of all Divisions of this Company's road, vice F. C. Hills, appointed General Traffic Manager.

Mr. F. C. Hills has been appointed General Traffic Manager of this Company, and will hereafter have full control and management of all its commercial business.

Mr. Walter J. Morris is Chief Engineer of the New York Underground Railway Company. His headquarters are in the Smith Building, No. 5 Courtlandt street, this city.

P. O'Reilly, a widely-known contractor of Reading, died on Monday, aged 71. His estate is estimated to be worth one million dollars. He was engaged in constructing public works in many sections of Pennsylvania.

William B. H. Hayes, a civil engineer, recently from Panama, who has been in the New York hospital since Dec. 16, suffering from malarial fever, died of exhaustion there last week and was buried on Friday, the 14th.

E. M. Sanborn, formerly an Assistant Engineer on the Boston Additional Water Supply, but recently engaged in the practice of his profession in Wyoming Territory, was thrown from a Mexican pony a few days ago, breaking his neck and killing him almost instantly.

Mr. R. A. Proctor will probably be appointed to organize the various English government expeditions for the observation of the transit of Venus in 1882. Mr. Proctor is also mentioned as successor to the Astronomer Royal, whose early retirement is predicted in scientific circles.

Mr. Wm. H. Law, for the past five years Engineer and Superintendent of the Milton Car Works at Milton, Pa., has resigned his position there to accept that of Manager of the Bellefonte Car Works, Bellefonte, Pa. These latter works were built in 1873, but have never been in operation. They formerly belonged to ex-Gov. Curtin, of Pennsylvania, but will be worked by Mr. William Lawson, of England, who has recently purchased them and employed Mr. Law as manager. The capacity of the works will be about eight cars per day. Mr. Law is now purchasing machinery for the works, which he expects to start up in about ninety days.

REMARKS ON HYDROSTATICS.

BY H. E. LICKS.

NO. 4—THE PROBLEM OF "HYDRAULICUS."

One "Hydraulicus," writing from Philadelphia, proposed in this paper for Nov. 6 last a problem regarding the hydrostatic pressure on an immersed triangle. The problem is an interesting theoretical one, and is apparently of some difficulty, since no one has attempted a solution, save a young man, writing from Holyoke (a town whose name comes from an Indian word Ho, meaning water), under a Latin motto, stating or signifying that he through a certain definite integral is able to conquer the question. But as even he, notwithstanding his cloud of symbols, algebraic, trigonometric and differential, arrives at no numerical result whatever, it has been thought well to remark here for a few minutes thereon, and to exhibit a simple and thorough solution of the said problem.

The question is the following: Required the normal water pressure and its point of resultant application on the surface of an immersed triangle whose sides are 5, 12 and 13 feet in length, the vertex opposite the shortest side being 8 feet below the surface, that opposite the longest side 4 feet, and that opposite the remaining side 3 feet.

The first part of the problem is very easy, for the normal water pressure is, as every one knows, equal to the product of the area of the triangle, the head on its center of gravity and the weight of a cubic unit of water, or $N = AHW$. Here we have A, the area of the triangle, equals $\frac{1}{2} \times 5 \times 12 = 30$ square feet, since it is right-angled; H, the head on its center of gravity, equals $\frac{1}{3}(3 + 4 + 8) = 5$ feet; and W, the weight of a cubic foot of water, is 62.4 pounds avoirdupois. Then N, the normal pressure, is equal to $30 \times 5 \times 62.4$, or 9,360 pounds.

The second part of the problem—to find the point of application of this pressure—is the difficult part. To obtain a clear understanding of the method of solution, consider first any surface submerged in water. On every point of it there is a unit pressure, p, due to the head, h. Taking the water level as a plane of reference, we must have—

$$Nq = \Sigma ph$$

as the equation of moments, from which q, the depth of the point of application of N below the water level, may be determined. Now, since $N = AHW$, and $p = ahW$, this reduces to

$$q = \frac{\Sigma ah^2}{AH}.$$

But the numerator of this is the moment of inertia of the surface and the denominator is the static moment of the surface, both with reference to the water level. Therefore to find the depth of the point of application of the resultant normal pressure on any surface it is only necessary to divide the moment of inertia of the surface by its static moment, thus,

$$q = \frac{I}{M}$$

both moments being taken with reference to the water level.

To apply this rule to the case in hand, let A be the area of the triangle, 30 square feet, and h_1, h_2 and h_3 be the heads on its vertices, namely, 3, 4

and 8 feet. Then from well known rules of mechanics,

$$I = \frac{A}{12}(h_1^2 + h_2^2 + h_3^2 + h_1 h_2 + h_2 h_3 + h_1 h_3),$$

$$M = \frac{A}{3}(h_1 + h_2 + h_3),$$

and we find with the greatest ease

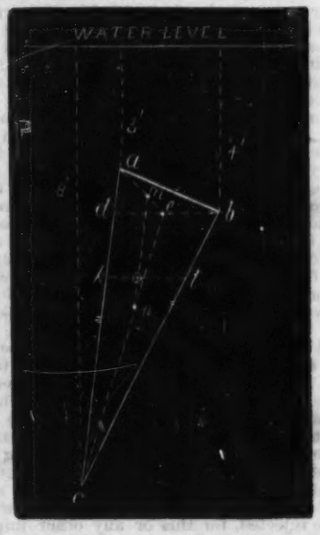
$$\frac{I}{M} = q = 5.2333 \text{ feet.}$$

This is the depth of the center of pressure of the triangle below the water level. To locate it on the surface of the triangle is now a simple application of simple principles of mechanics and geometry.

Let *abc* represent the given triangle, and let *kl* be a line on its surface parallel to the water level, and 5.2333 feet below it. From similar triangles we find

$$bl = 3.7000 \text{ feet}$$
$$ak = 5.8066 \text{ "}$$

and joining the points *k* and *l*, we know that the centre of pressure lies on it. To find where, draw *bd* parallel to *kl*, let *m* represent the center of pressure on the triangle *bad*, and *n* that on the triangle *bcd*. Then evidently the center of pressure of the triangle *abc* must lie on the line joining *m* and *n*. But it also lies on *kl*, hence it is at the intersection of the two. We find, as before, from the rule:



Depth of m = 3.0816 feet
Depth of n = 5.5000 "

Then from the triangles we find in succession:

ad = 2.6 feet.
ae = 3.8 feet.
ce = 11.2 feet.
am = 2.5909 feet.
cn = 7.0000 feet.

The following is, therefore, the construction for finding the point of resultant water pressure on the given triangle: Lay off the above values of *ak* and *bl* and join *k* and *l*. Draw *bd* parallel to *kl* and bisect it in *e*. Join *a* with *e*, and *c* with *e*, lay off on *ae* the above value of *am*, and lay off on *ce* the above value of *cn*. Join *m* with *n*. The intersection of *kl* and *mn* will be the point required, and on the above sketch it is neatly marked by a small circle.

Here end the remarks on hydrostatics. *Selah!*

CORRESPONDENCE.

A. D., Montreal, Canada.—Mr. J. T. Gardiner is director of the New York State Survey, with headquarters at Albany, N. Y.

H. J. H., Milwaukee, Wis.—There are 70 numbers to the "Circle of Sciences;" the price is 30 cents per number. We will send your missing numbers next week as soon as delivered to us by the publishers, and can supply any other numbers wanted.

M. T. P., Richmond, Va.—Drinker's "Tunneling," new or second hand, is not for sale at present, the first edition being all sold out. A new edition, with additional matter, relating principally to the Hudson River Tunnel, is in preparation, and will be ready in a few months.

D. C., Green Bay, Wis.—We do not know of any book for computing earthwork of narrow-gauge railroads except Wellington's "Computation of Earthwork by Diagrams," which we suppose is equal to the requirement. There are no copies of this at present for sale, so great has been the demand for the past few months, but a new supply is promised by the publishers about Feb. 1. It is *the* standard book for earthwork calculations.

TO MANUFACTURERS OF STRUCTURAL IRON.

OSWEGO, LABETTE CO., KAN., Jan. 17, 1880.

EDITOR ENGINEERING NEWS:

I wish to become acquainted with at least the approximate cost of the different iron and steel manufactures used in bridge construction—the cost per pound or foot, and, if per pound, the number of pounds per foot of the different sizes of angle-iron, bar-iron, iron rods, pins, etc., ready for use.

If you know of any price-list, or other publication containing such information, I will thank you to publish the same. Yours truly,

M. J. WELLS.

Manufacturers of bridge material will please send price lists. We propose to give market reports about once in two weeks; if the market is not changing we may not quote prices so often.

HENCK'S FIELD BOOK.

OHIO CENTRAL RAILROAD, ENGINEER'S OFFICE,
Toledo, O., Jan. 17, 1881.

EDITOR ENGINEERING NEWS:

In the issue of Jan. 15, "L. B. O." wishes to hear from "any one who knows of any more" errors in "Henck's Field Book." I give you a list below which I believe to be complete. Those marked * have already been noticed in ENGINEERING NEWS:

Page 139, $\sqrt{110}$ reads 10.4880085, should read 10.4880885.
Page 140, $\sqrt{138}$ reads 11.7473444, should read 11.7473401.
Page 148, 667² reads 444889, should read 444889.
Page 180, sin. 12° 30'° reads 9.355437, should read 9.335337.
Page 207, sin. 33° 37'° reads 9.743235, should read 9.743223.
Page 207, sin. 33° 49'° reads 9.745594, should read 9.745494.
Page 208, cos. 34° 55'° reads 9.913866, should read 9.913806.
Page 227, sin. 38° 4' reads .61958, should read .61658.
Page 153,* $\sqrt{936}$ reads 9.7829466, should read 9.7819466.

The above has been gathered from various sources: some discovered, others from classmates and still others from Mr. Henck himself.

C. BUXTON.

CONTRACTS AND CONTRACTORS.

PITTSBURGH, Pa., Jan. 14, 1881.

EDITOR ENGINEERING NEWS:

ENGINEERING NEWS for Jan. 8, 1881, contains an article, "Contracts and Contractors," in which the idea is that contractors are badly treated, because engineers compel them to live up to the specifications. In my opinion the trouble is not in living up to the specifications, for no contractor will object to doing the work as agreed upon provided he has a corresponding price. The trouble is that engineers expect perfect work for a very low price, but for a low price the contractor will, if possible, give imperfect work. I think I learned some time ago that a dollars' worth of work could not be done for 99 cents. If the engineer gets the work, then the contractor pays the cent; if he does not, his men, who are least able to do so, pay it. Again, engineers write their specification as if but one party had any rights, they also put *more in than they intend* to carry out, and this is known to contractors, and the result is that those who bid to perform all that is called for will be higher than those who are ready to risk it, and slight the work if they can. Now, this is unfair to the honest bidder, and I think engineers should put in the specifications *just what it is proposed the successful contractor shall perform, and no more.* They should also remember that both parties have rights.

The engineer should then compel the contractor to do as he has agreed, and I think neither would have cause to complain, and the result would be that an honest contractor would soon have a fair price, for those who propose to give poor work for low pay would stop bidding. Suppose I bid for work covered by specifications that call for first-class work, and they all do, even when a poorer class will be accepted, where the *lowest* responsible bidder is to receive the award. If I bid to do the work as specified, I shall be too high, and some other who will take the risk of slighting the work will receive the award.

Or, on the other hand, suppose I take the risk, have I any cause to complain if I am, after all, compelled to do the work as specified?

We often hear of work being let so low that the contractor loses money. There are two reasons for this. 1st. Some contractors are ready to take the risk and bid to do work less perfectly than the specifications call for. 2d. There is a class of so-called contractors, who, having seen that Smith, Brown or Jones make money, think that they can, and this being all they do know about it, their price is too low.

I do not believe a contractor can be made in a day and by seeing incidentally that others make money. Contracting is as safe as any other business, if carried on in a business way.

The engineer who is competent to fill the position can estimate as close to the cost of the work as the contractor, and this being the case, the engineer should have some discretion as to who shall obtain the work, even if not the lowest bidder. Often all that can be collected from the bondsmen does not pay for the time lost.

Respectfully, J. H. HARLOW.

SPRINGFIELD, MASS., SEWERS.

SPRINGFIELD, Mass., Jan., 1881.

EDITOR ENGINEERING NEWS:

I send you by to-day's mail a complete set of the reports of our water commissioners, as far as published. I see you publish most of the material facts not yet in print, as taken from the mayor's address, in your issue of Jan. 15, credited to *Boston*. Whether that be the printer's fault or not, of course makes little difference. If of sufficient interest, please correct.

I inclose also tariff of water rates, and as soon as the last report is in print will forward that also. Any further fact worthy of a place in your history of the water-works of this country, which I can supply, regarding our own works, I shall be most happy to do.

During the past season, under the direction of a special committee of the City Council, I have collated considerable information regarding the sewers of our city, of which the following may furnish you an item:

Materials.	Length in feet.	Length in miles.
Brick and cement mortar	37,209	7.04
Miscellaneous	15,237	2.88
Vitrified pipe	360	0.07
Cement pipe	104,443	19.78
	157,233	29.77

Cost of construction	$257,163.72
Cost of repairs and maintenance, 1863 to 1880 inclusive	38,178.38
	$295,342.10
Amount received for entrance fees	$84,462.76
Amount of assessments and gratuities	22,668.55
Total receipts	$107,131.31
Number of premises connected with sewers	2,032
Number of premises to be connected with sewers	1,611
Number of estates on line of sewers already connected	3,643

When the entire report is in print, I will send you a copy.

Why does your correspondent on bridges give

cost in £. s. d.? It seems to me that American engineers can afford to be American, the Bank of England and the metric system to the contrary notwithstanding. Yours truly,

GEO. A. ELLIS.

[We have received the water reports kindly sent us by Mr. Ellis, and we hope his early response to an invitation for contributions to our proposed "History of American Water-works" will be promptly and universally imitated by other engineers and superintendents of water-works. We note the error referred to in the 3d paragraph of 3d col., page 29, in using "Boston" for "Springfield." The use of pounds, shillings and pence instead of dollars and cents in Mr. Clarke's paper on iron bridges is a natural consequence of its being read and published by an English society. It can readily be expressed in American denominations at the rate of five dollars to the pound.]

FLOW OF WATER IN PIPES.

46 Lexington st., Baltimore,
Jan. 13, 1881.

EDITOR ENGINEERING NEWS:

In your paper of 23d October last, p. 352, "Engineer" asks which of several formulæ for the discharge of water through pipes gives the best result. As no one has yet given an answer, I will do so:

1. Dubuat, "the creator of the science of running water," in 1874 published his formula, the principles of which have not been greatly modified by later hydraulicians.

2. Prony, in 1802, established the more simple rule, which bears his name, and determined the coefficients.

Both these formulæ were based upon forty-four experiments, made with pipes of tin one or two inches in diameter, and seven made by Couplet in 1732 upon large cast iron pipes, rough with calcareous deposits. Misled by these experiments, in which the smooth surface of the tin, as compared with the rough interior of the iron pipe, compensated for its smaller size, it was concluded that the velocities were independent of the condition of the surface as to smoothness, and, to a certain extent, of the diameter of the pipe.

3. In 1814–15 Eytelwein published his new coefficients for the Prony formula, obtained from a comparison of a great number of experiments, including those used by Dubuat and Prony. As the formula takes no account of important conditions which affect the discharge, the generalization of the results of a large number of observations renders it more generally applicable, but with a wider range of error.

4. The formula of Box is that of Prony, with a different coefficient. Neville's is formed from Eytelwein's.

It was long ago recognized that these formulæ gave results varying sometimes 50 per cent. from those observed. Mr. Kirkwood, in 1858, reports experiments on the Jersey City water pipes which vary from 28 to 35 per cent. from calculated quantities. But in the same year M. Henri Darcy, the engineer in charge of the distribution of Paris, published the results of the very extensive and complete experiments made by him, with the tables and formulæ to represent them. He concludes that Prony's rule (then in almost exclusive use in France) does not attach sufficient value to the diameter of the pipe, and that, contrary to the general belief, the condition of the surfaces exercised a marked influence upon the discharge. The extensive scale upon which these observations were made, the care bestowed upon them, and their skillful reduction, have obtained for his conclusions universal assent.

We may therefore conclude that none of the formulæ named by your correspondent can be relied upon to give more than the rudest approximations.

What rules, then, can be safely used? The more exact formula of Rankine, which is deduced from Darcy's observations, gives correct results for new pipes; but, according to Darcy's recommendation, the coefficient of "friction" must be doubled to compensate for the slight roughness which, sooner or later, forms in all pipes in permanent use. Fanning's tables and formulæ are doubtless to be relied upon, as well as those of Darcy, given in "Humber on Water Supply," No. 46, page 66, of American edition. Both of these, however, require the use of tables or diagrams to avoid long calculations, especially where the diameter of the pipe is the required function.

For the cases, common enough in this country, where, by reason of the absence of the carbonate of lime, etc., in the water, large tubercles form on the interior of iron pipes, by which the smaller sizes are sometimes almost or entirely closed, no formula can be of any use. The degree of roughness and of reduction of size of the pipe varies in every case, and is not susceptible of formulization, although it has been given for particular instances. But in such circumstances coated pipe only can be used. For those lined with asphalte (bitumenized), Darcy finds a coefficient two-thirds of that for new cast-iron pipes. W. R. HUTTON.

THE DESIGN GENERALLY OF IRON BRIDGES OF VERY LARGE SPAN FOR RAILWAY TRAFFIC.

BY THOMAS CURTIS CLARKE, M. A. S. C. E.; M. INST. C. E.

APPENDIX II.—CINCINNATI SOUTHERN RAILWAY.

(*Continued from page 28.*)

1. *Ohio River Bridge Specifications.*

SUPERSTRUCTURE.

"The superstructure of this bridge will be of iron, with the exception of cross-ties and guard timbers.

"Bidders will furnish a general plan with detail drawings and diagrams of strains for each span, otherwise their tender will not be received.

"The bridge must be not less than fourteen (14) feet in width in the clear, and not less than eighteen feet six inches (18½) in height in the clear, measuring from the top of the rail. The roadway on each span will be constructed so as to leave on the rail only one-half of the camber of the truss.

"The channel span of bridge shall not be less in width than twenty (20) feet from center to center of trusses.

"The draw must be geared for both hand and steam power, so as to turn either way. All machinery for the same must be furnished and put in place by the contractor.

"The hand gearing must be so arranged that two men can easily turn the draw in a calm day in two and one-half minutes.

"Steam power must be applied of sufficient capacity to turn the draw in one minute, with a pressure of 40 lbs. to the square inch.

"The bearing of the ends of the draw on the piers must be firm, so as to insure a smooth track for the passage of trains. All locks must be worked by gearing from the center of the draw, and be self-adjusting when the draw is 6 inches out of line.

"Not more than three (3) feet and three (3) inches shall be occupied from the base of the rail to the lowest point in the superstructure of the bridge.

"*Rolling Load.*—All parts of the bridge must be proportioned to sustain the passage of the following rolling load, at a speed of not lees than thirty miles per hour, viz: two locomotives coupled, each weighing 36 tons on drivers, in a space of 12 feet; total weight of each engine and tender loaded, 66 tons in a space of 50 feet, and followed by loaded cars weighing 20 tons each in 22 feet. Weight of locomotive and tender to be distributed according to the following diagram. An addition of from 10 to 30 per cent. will be made to the strains produced by the rolling load (considered as static) in the calculation of floor beams, stringers, suspension-links, counter-rods, and all other parts of the bridge which are liable to be thrown suddenly under strain by the passage of a rapidly moving load. Vertical lateral rods and struts must be of sufficient strength to resist, in addition to the live and dead load, a pressure of wind equal to 50 lbs. per square foot.

"*Dimensions of Parts.*—The iron-work shall be so proportioned that the weight of the structure, including the floor, with 125 lbs. per lineal yard added for rails, spikes and joints, together with the above specified rolling load, shall in no part cause a tensile strain of more than 10,000 lbs. per square inch of sectional area, nor a shearing strain of more than 7,500 lbs. to the square inch. The strain in compression will be reduced with the ratio of diameter to length of post, according to the Gordon formula, with a factor of safety of one-sixth. Columns for testing shall be furnished by the contractor. Experiments will be made under the direction of the engineer, to determine the limit of elasticity, and also the ultimate strength of the metal to be applied in the formula. In all members subject to transverse strains the maximum compression must not be more than 8,000 lbs. per square inch.

"Shearing strain on pins must not be more than 7,500 lbs. per square inch. The strain on semi-intrados of eyes not more than 10,000 lbs. per square inch, or the compressive area not less than the section of the bar. The eye must not be less in strength than the body of the bar.

"*Quality of Iron.*—Iron used under tensile strain shall be tough, ductile, of uniform quality, and capable of sustaining 60,000 lbs. per square inch of sectional area without fracture, and 25,000 lbs. per square inch of area, with a smart blow from a hammer while under strain, without taking a permanent set. The reduction of area at breaking point shall average 25 per cent.; elongation 15 per cent.; when cold it must bend without sign of fracture from 90° to 180°.

"Iron used under compressive strain must be tough, highly fibrous of uniform quality, and capable of sustaining 25,000 lbs. per square inch of area without taking a permanent set.

"The engineer will have the privilege at any time to select any of the bars manufactured for the bridge, cut from the same specimen bars, 1½ inches in diameter and 12 inches long, and submit them to the foregoing tests. Should the bars thus tested fail to stand the tests, this will be considered sufficient evidence that the iron used does not comply with the requirements of the specifications.

"All bars subject to tensile strain shall be tested by the contractor, under the direction of the engineer, to 20,000 lbs. per square inch of sectional area, with a smart blow from a hammer while under strain, without permanent set. While under the test strains, should any bar extend or contract more or less than it should do according to coefficients of extension and contraction previously determined from experimental tests of sample bars of the grade of iron to be used, all such bars shall be rejected, for this or any other imperfection. A variation of $\frac{1}{1000}$ of an inch per foot each way for a strain of 20,000 lbs. per square inch of area will be allowed. Bars subject to shearing strain shall be of the best quality of iron, and subject to such tests as the engineer may desire.

"Every bid must be accompanied by six specimen bars, 1½ inches in diameter, and 12 inches long, stamped with the name of the bidder, and to be of the quality of iron that is intended to be used. All iron used in the bridge must be equal in strength and all other qualities to the specimen bars.

"*Castings* must be made of good tough cast iron; metal not less than ¾ inch in thickness, and be subjected to the following test: A bar of iron 5 feet long, 1 inch square, 4 feet 6 inches between supports, shall bear a weight of 550 lbs. suspended at the center. The engineer may at any time require such specimen bars to be cast from the same metal as that used in the structure. No castings will be permitted in the bridge except in the minor details.

"*Workmanship.*—All workmanship must be first-class. All abutting joints must be planed or turned. One-sixty-fourth of an inch will be the maximum error allowed in eye bars, and not more than one-hundredth of the diameter of the pin or hole.

"In riveted work all joints shall be square and truly dressed. Rivet holes shall be spaced accurately and directly opposite each other. Rivets must be of the best quality of iron, and must completely fill the holes. The area of rivets shall not be less than the sectional area of the joined pieces.

"Ends of bars having threads upon them must be enlarged beyond the diameter of the bar, enough to make the bar full size at the bottom of the thread.

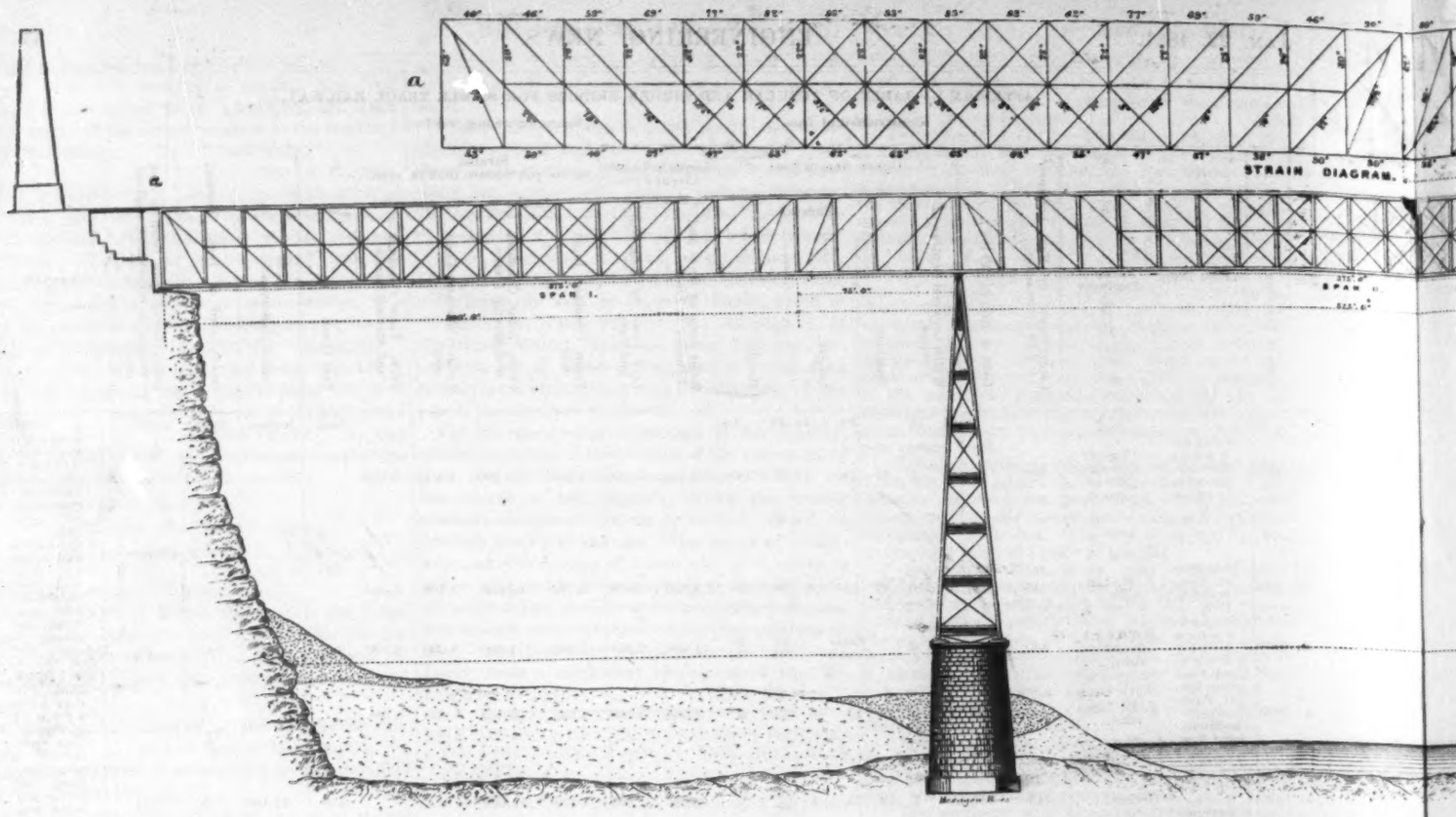
(CONTINUED ON PAGE 38.)

APPENDIX I.—TABLE OF TUBULAR AND GIRDER BRIDGES FOR SINGLE TRACK RAILWAY.

Constructed of Iron. Spans exceeding 300 feet.

No.	Date of Erection.	Where Built.	Name of Engineer.	Clear Span in Feet between Points of Bearing.	Tons of Iron (2,240 lbs.).	Dimensions in Feet.						Loads in lbs. per Lineal Foot.		Strains, in lbs. per Square Inch of Area.				Test Load.	Center Deflection.	Dead Load of Iron, Timber, etc.	Deflection of span from its own weight on removal of scaffolding.	REMARKS.
						Width between Centers of Girders.		Panels: Number.	Panels: Length.		Height.	Dead Load of Iron and Timber in Track.	Live Load of Engines and Cars.	Tensile. From Constant Load only.	Tensile. From Total Constant and Moving Loads.	Compressive. From Constant Load only.	Compressive. From Total Constant and Moving Loads.					
						Ft.	In.		Ft.	In.	Ft.	In.							Tons.	Inches.	Tons.	Inches.	
1	1877	Susquehanna River, Havre de Grâce, U. S.	Phoenix Bridge Company.	307	215	16	0	17	18	2	35	0	2,150	2,240	4,900	10,000	4,400	9,000	.....	.....	.....	.....	All rolled iron except joint blocks. Pin connections; quadrangular girder.
2	1864	Ohio River, Steubenville, U. S.	J. H. Linville	319	484	16	6	26	12	3	38	0	4,000	3,000	5,700	10,000	3,100	6,000	.....	.....	.....	.....	Top chords and posts of cast iron, rest of rolled iron; quadrangular girder.
3	1859	St. Lawrence River, Montreal, Can.	Robert Stephenson.	330	686	16	0	Ends / Center			22 / 30	0 / 0	4,800	2,240	7,680	11,200	6,080	8,900	385	1⅝	743	7½	Tubular girder.
4	1870	Ohio River, Parkersberg and Bellevaire, U.S.	J. H. Linville	342	338	18	0	22	15	6	33	0	2,500	3,000	4,545	10,000	3,636	8,000	.....	.....	.....	.....	All rolled iron. Pin connections; quadrangular girder.
5	1862	Rhine River, Mayence	Gerber	345	359	15	1	13	25	4	24 / 49	6 / 2	4,590	2,800	7,120	11,000	.....	.....	450	27-100	719	2¼	Pauli system; all riveted work; lenticular girder.
6	1870	Ohio River, Louisville, U.S.	Albert Fink.	308	407	30	0	24	15	4	46	0	3,008	2,000	7,000	Chords 12,000 / Diag. 10,000	3,500	6,000	200	1	.....	.....	Top chords cast, rest rolled iron. Pin connections; quadrangular girder.
7	1877	Kentucky River, Dixville, U. S.	C. Shaler Smith.	375	425	18	0	20	18	9	37	6	2,700	2,037	5,080	10,000	4,570	9,000	331	1 62-100	.....	.....	All rolled iron. Pin connections; quadrangular girder.
8	1870	Ohio River, Louisville, U.S.	Albert Fink.	390	623	30	0	28	14	2	46	0	4,168	2,000	7,400	Chords 12,000 / Diag. 10,000	3,700	6,000	200	1¼	.....	.....	Top chords cast, rest rolled iron. Pin connections; quadrangular girder.
9	1856	Vistula River, Dirschau	Lentze	307	838	21	8	Close Lattice			28	6	6,160	2,128	7,220	9,720	7,220	9,720	.....	.....	.....	.....	All rolled iron, one line of rails only taken. Close lattice with posts two spans continuous.
10	1848	Conway ...	Robert Stephenson	400	1,112	15	0	Tube			25	6	6,450	2,240	9,200	12,400	.....	.....	300¼	2 13-100	1,112	8 3-50	Tubular girder.
11	1871	Ohio River, Cincinnati, U. S.	J. H. Linville	415	830	19	0	20	20	9	41	6	5,500	4,500	5,500	10,000	4,950	9,000	.....	.....	.....	.....	Carriage way on each side of railway. Pin connections; quadrangular girder.
12	1861	Inn River, Passau	.....	320	327	15	0	23	14	0	30	0	2,450	2,680	6,700	13,700	5,900	12,000	165	13-100	396	9-10	Riveted lattice. All rolled iron.
13	1850	Saltash ..	I. K. Brunel	455	945	17	0	12	38	0	30 / 60	0 / 0	6,500	2,240	6,650	8,960	.....	.....	384	1 2-10	1,100	2½	Lenticular girder.
14	1850	Menai Straits, Britannia Wales ..	Robert Stephenson.	460	1,553	15	0	Tube			30	0	7,780	2,240	10,375	13,536	.....	.....	248	68-100	1,553	11 75-100	Tubular girder.
15	1868	Lek River, Kuilenburg, Holland	G. Van Diesen.	402	2,234	30	4*	38	13	1	26 / 65	3 / 7	13,200	3,000	11,800	14,500	8,200	10,000	595	1 32-100	2,890	3 1-20	All rolled iron, riveted. Lattice arched top.
16	1877	Ohio River, Cincinnati, U. S.	J. H. Linville	515	1,176	20	0	20	25	9	51	5	5,400	1,818	7,470	10,000	6,000	9,000	431	2	1,238	See Remarks.	All rolled iron. Pin connections; quadrangular girder. Estimate camber, 4½ inch.; actual, 3⅝ inch.

* It will be noticed that the width of the Kuilenburg bridge, 30 feet 4 inches, is sufficient for two lines of way, although only one line has been laid.—T. C. C.



KENTUCKY RIVE

AMERICAN BRIDGE CO.'S COLUMNS. TESTS MADE AT CHICAGO.

No.	Kind	Diameter.	Length.	Ratio of length to diameter.	Sectional area.	Square of radius of Gyration. (Unit = 1 inch.)	Limit of elasticity.	Resistance per square inch = "P" / S	Modulus of elasticity.	"f" by Gordon formula.	"f" by Rankine formula.	Remarks.
		Inches.	Ft. In.		Sq. In.		Lbs.	Lbs.				
12	Flat ends.....	10×9⅛	20 0	25.3	20.10	8.653	15,000	.....	.....	.....	.....	Uneven bearings at ends; test discontinued after a pressure of 19,000 lbs. per square inch had been obtained.
18	"	10×9⅛[1]	20 0	25.3	20.10	8.653	23,000	31,500	23,600,000	37,500	37,300	Same column as above tested second time. Bent sideways.
19	"	10×9⅛	27 0	34.1 (32.4)	20.10	13.510 (8.635)	24,000	27,800	32,900,000	38,600 (37,500)	33,700 (37,200)	Bent upward. The numbers between parentheses apply to the column bending sideways.
15	"	8⅛×8[1]	30 0	45.0	14.97	5.388	13,000	23,700	26,000,000	39,700	39,500	Bent sideways.
16	Hinged ends...	8×8[1]	30 0	30.0	12.50	5.479	15,000	26,700	28,900,000	42,700	42,300	" "
17	"	10⅛×10[1]	20 0	24.0	19.90	8.733	12,000	26,500	23,100,000	30,700	36,200	" "
13	"	12×10⅛[1]	26 0	29.0	25.05	18.215	12,000	24,000	30,400,000	37,500	31,100	Bent downward.
14	"	10⅛×10[1]	26 0	31.2	29.72	8.733	14,000	22,000	26,000,000	36,300	35,600	Bent sideways.

[1] Diameters used in obtaining the value of "f" by Gordon formula. Hinged ends in above table mean pin bearings.

PHŒNIX COLUMNS. TESTS MADE AT CHICAGO AND PITTSBURGH.

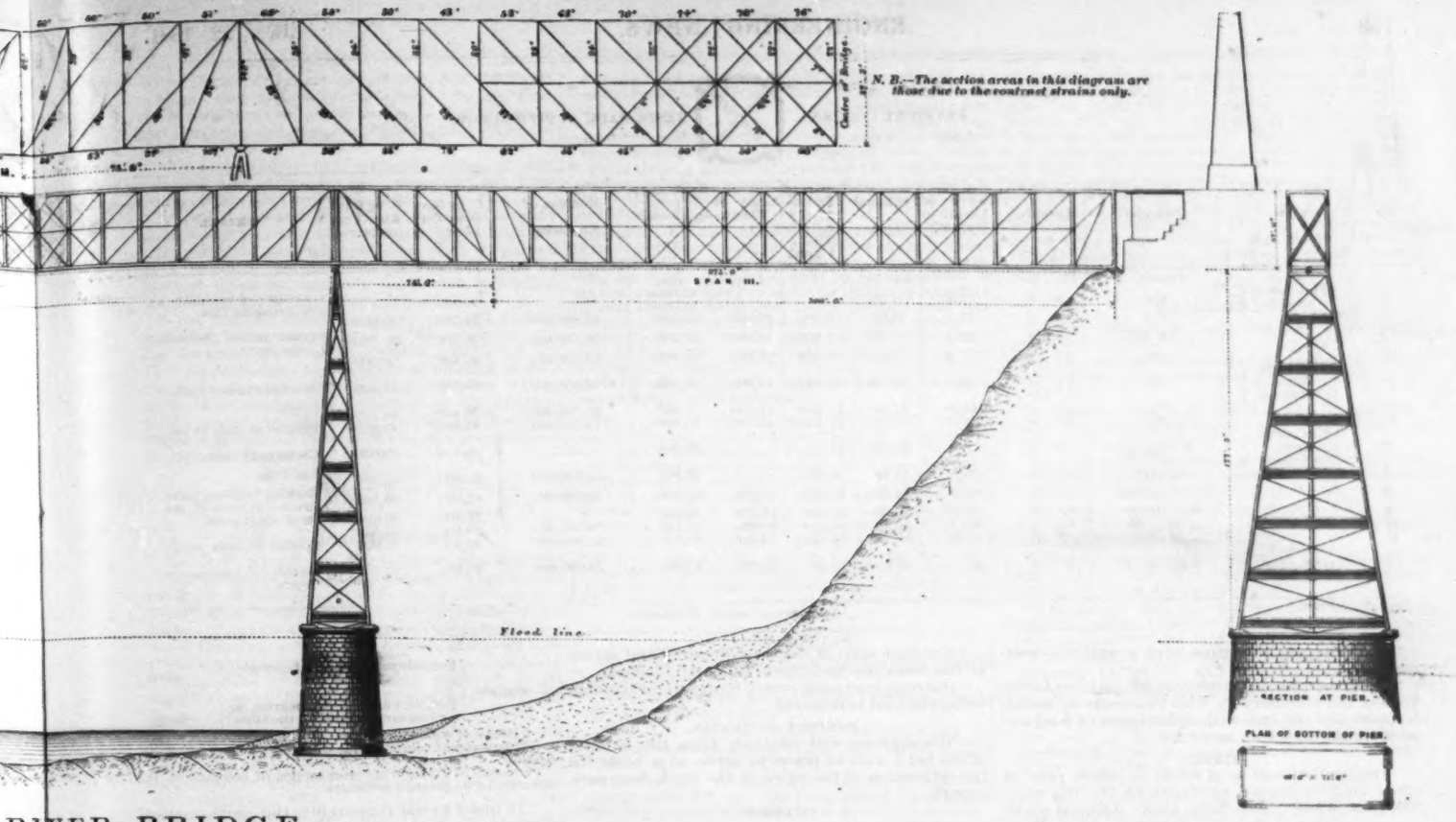
6	Flat ends. ...	8.05	15 0	22.4	14.09	8.536	35,000	37,500	27,400,000	43,700	41,500	Had been compressed previously.
10	"	8⅛	27 0	39.9	13.70	8.935	18,000	31,000	29,100,000	47,400	41,100	Ends riveted closely.
28	"	8⅛	28 0	40.7	13.58	8.935	22,000	34,800	25,700,000	54,600	47,000	" " "
29	"	8⅛	28 0	40.7	13.58	8.935	18,000	36,600	28,500,000	57,500	49,400	" " "
11	Ends rounded with large radius.	8⅛	27 0	39.9	13.89	8.935	17,000	21,700	27,100,000	44,700	35,900	By formulæ for hinged ends.
										67,700	50,000	By formulæ for round ends.

Hinged ends in above table mean pin bearings.

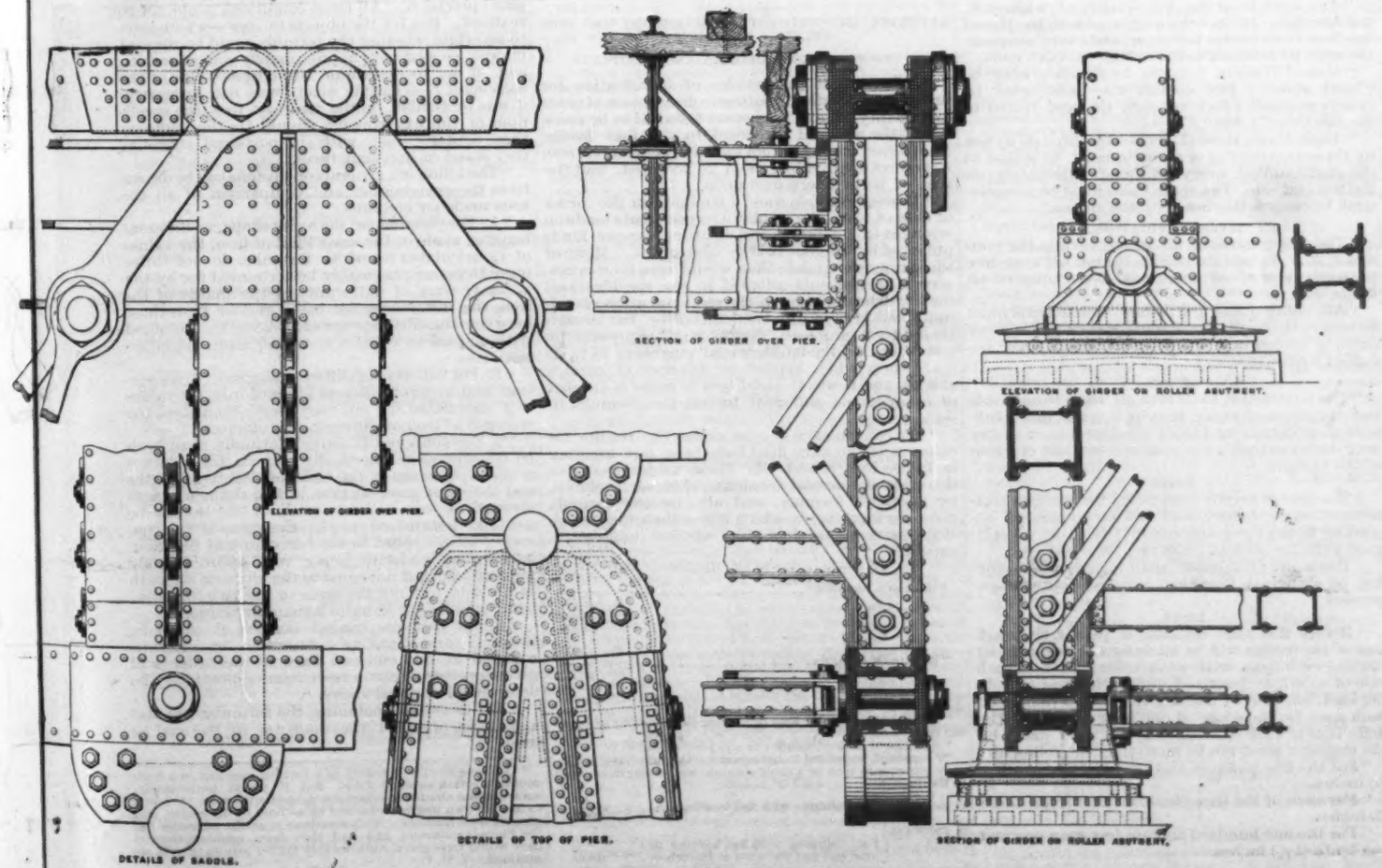
SQUARE COLUMNS. TESTS MADE AT CHICAGO AND PITTSBURGH.

23	Flat ends.....	10×8 7-16[1]	24 0	34.1	13.70	11.628	15,000	33,200	28,900,000	46,100	39,800	Baltimore Bridge Co. Bent downward.
22	"	10 × 7⅛[1]	26 0	41.6	13.60	9.347	18,000	30,000	27,800,000	47,300	38,700	Louisville Bridge Co. Bent upward.
32	"	10⅛ × 9¼[1]	27 0	30.9	26.05	10.909	15,000	30,200	30,100,000	39,800	38,300	Keystone Bridge Co. Bent sideways.
21	Hinged ends...	10 × 7⅛	25 9	30.9	13.60	11.000	18,000	25,500	31,000,000	41,700	37,800	Louisville Bridge Co. Bent sideways.

[1] Diameter used in obtaining "f" by Gordon formula.


N. B.—The section areas in this diagram are those due to the contract strains only.
Centre of Bridge.
SPAN III.
Flood line.
SECTION AT PIER.
PLAN OF BOTTOM OF PIER.

RIVER BRIDGE.


SECTION OF GIRDER OVER PIER.
ELEVATION OF GIRDER ON ROLLER ABUTMENT.
ELEVATION OF GIRDER OVER PIER.
DETAILS OF SADDLE.
DETAILS OF TOP OF PIER.
SECTION OF GIRDER ON ROLLER ABUTMENT.

DETAILS OF KENTUCKY RIVER BRIDGE.

KEYSTONE COLUMNS. TESTS MADE AT PITTSBURGH.

No.	KIND.	Diameter.	Length.	Ratio of Length to Diam'r.	Sectional Area.	Square of Radius of Gyration. (Unit = 1 inch.)	Limit of Elasticity.	Resistance per sq. inch = "p" / S.	Modulus of Elasticity.	"f" by Gordon Formula.	"f" by Rankine Formula.	REMARKS.
		Inches.	Ft. Ins.		Sq. In.		Lbs.	Lbs.				
1	Flat ends, closed.	8¼	0 9	1.1	14.25	.....	.....	45,000a / 51,500b	.....	.....	.....	(a) Signs of buckling. (b) Crushing fast.
7	"	8.3	15 0	21.7	14.62	9.200	17,500	30,000	23,800,000	34,700	32,000	
9	"	8.85	15 0	20.3	23.67	7.833	19,000	32,000	24,700,000	36,400	35,700	Cross plates between flanges.
27	"	8⅝	27 0	37.6	18.83	9.798	18,000	27,800	23,700,000	40,800	36,000	
24	Flat ends, open, straight.	9½	27 0	34.1	19.20	12.041	15,000	27,000	26,500,000	34,700	31,100	Riveted diametrically.
26	"	9⅝	27 0	34.6	14.49	11.178	17,000	27,500	27,500,000	38,400	34,700	
30	"	9⅝	27 0	34.1	15.13	11.464	12,000	30,000	19,300,000	42,100	37,600	Riveted at ends 18 ins.
2	Flat ends, open, swelled.	9.3×10.1[1]	5 0	6.5	14.25	11.044	.....	33,600	....	34,100	33,900	Castings at ends.
3	"	9¼×11¼[1]	15 0	19.5	14 84	10.834	.....	28,800	34,600,000	32,400	31,200	" " "
8	"	9 ×11⅛	15 0	20.0	14.80	10.353	15,000	36,800	29,600,000	41,800	40,100	Buckled between bolts. Riveted at ends 12 ins.
4	"	9.2×11.62[1]	27 0	35.2	12.96	10.883	16,700	24,100	....	34,100	30,600	Castings at ends.
25	"	9⅝×12[1]	27 0	33.7	18.83	11.424	12,000	21,100	28,100,000	29,100	26,500	" " "
31	"	9½×12[1]	27 0	34.1	15.13	11.464	16,000	25,400	23,600,000	30,100	31,900	Riveted at ends 18 ins.
5	Hinged ends, open, swelled.	9 22×11.6[1]	27 0	35.1	13.12	10.945	15,000	22,000	29,500,000	40,100	33,700	Bolted to castings at ends.

[1] Diameter at center of columns.

"Washers and nuts must have a uniform bearing.

"*All Iron* must be painted on all surfaces before leaving the manufactory with two coats of metallic paint and oil, and with a third coat of lead and oil after the structure is erected.

TIMBER.

"The timber shall be of white or yellow pine, or other kind of timber approved by the engineer, free from wind shakes, large knots, decayed wood, sap, or any defect that will impair its strength or durability. No sap angle will be allowed. All timber must be inspected by the engineer and none used without his approval. All framing must be done in a thorough and workmanlike manner.

"*Ties* must be of the best quality of white oak, not less than 13 feet in length; must be placed one foot from center to center, and every alternate tie must be fastened to the stringer at both ends.

"*Guard Timbers*, 6 inches by 8 inches, must be placed about 1 foot outside the rails, must be closely notched 1 inch on each tie, and bolted to the ties every 4 feet.

"*Angle Irons*, three (3) inches by three (3) inches by three-eighths ($\frac{3}{8}$) of an inch, must be spiked to the guard timber every 18 inches alternately on the top and side. The spike holes must be countersunk to receive the heads of the spikes.

RIVER NAVIGATION.

"The river must at all times during the construction and erection of the bridge be kept free for navigation of steamers, coal-fleets, tows of all kinds, and rafts.

"All coffer-dams and other obstructions must be removed by the contractor, leaving the river entirely unobstructed, except the actual space occupied by the masonry.

RISKS.

"The contractor shall take all risks from floods and casualties of every description, and must furnish all materials and labor incidental to or in any way connected with the construction and erection of the bridge.

TIME.

"The bridge hereby contracted for shall be commenced on or before ——, and be completed according to the foregoing specifications, in compliance with the attached contract by ——.

"The word 'Engineer' shall mean the Consulting or Principal Engineer, unless otherwise expressed.

TESTS.

"Before the final estimate is paid, a thorough test of the bridge will be made by the engineer, by loading each span with such rolling load, at such rate of speed, as described under the head of rolling load, and also by causing the load to remain on each span for the space of one hour or more. The deflection of each span during the tests made by the engineer must not be more than the following:

"For the five hundred and twenty feet span five (5) inches.

"For each of the three hundred feet spans three (3) inches.

"For the one hundred and ten feet span one and one-tenth ($1\frac{1}{10}$) inches.

"For each span of the three hundred and seventy feet draw one and eight-tenths ($1\frac{8}{10}$) inches.

"And each span must return to its original camber when the load is removed.

MONTHLY ESTIMATES.

"The engineer will establish from the amount of the bid a scale of prices to serve as a basis for the estimation of the value of the work done each month.

CHANGES.

"The Trustees reserve the right to change the depth of the foundations, and sizes of the piers, and abutments, as described in the foregoing specifications."

APPENDIX III. EXTRACT FROM REPORT OF CONSULTING ENGINEERS.

TESTS OF IRON COLUMNS AND STRUTS.

"According to the articles of specification for bridges and trestles, relating to dimensions of posts and quality of iron, numerous tests had to be made before the material furnished by the four bridge companies, among whom the contracts for our iron structures are divided, could be accepted, and the sizes of posts determined upon.

"Tables Nos. 4, 5, 6 and 7 contain, in the order of date of tests, the results of experiments made on wrought-iron columns and struts of various kinds prepared by the four bridge companies. More of these tests were made than would have been necessary if the formula adopted in the specifications for the determination of the sectional areas of columns had been of universal authority, but though the best yet proposed, doubts were expressed by competent bridge-builders and engineers as to its correctness when applied to columns of certain shapes, and it was thought best to make a number of experiments sufficient to test the formula itself.

"For convenience of comparison the results for columns of the same kind have been put together in Tables Nos. 12 and 13. These tables also give the value of constant f, calculated for each column, by Gordon's formula, and also by the formula given by Rankine, in which the radius of gyration of the section is used in place of the smallest diameter.

"Gordon's formula ..... $\frac{P}{S} = \frac{f}{\frac{a\,l^2}{1+A^2}}$

"Rankine's formula ..... $\frac{P}{S} = \frac{f}{\frac{a'\,l^2}{1+r^2}}$

"P being the ultimate load producing the crushing or bending of column.

"S sectional area of column in square inches.

"f constant, supposed to be equal to the ultimate resistance per square inch of a short column, whose length is equal to its diameter.

a constant { For columns with flat bearings ..... = $\frac{1}{3000}$; For columns with flat bearing at one end and rounded at the other. = $\frac{2}{3000}$

a' constant { For columns with flat bearings ..... = $\frac{1}{36000}$; For columns with flat bearing at one end and rounded at the other. = $\frac{1}{36000}$

"l, length of column in inches.

"h, diameter of column in the direction of its greatest deflection.

"r, radius of gyration of cross-section of columns in the direction of its greatest deflection.

"In order to test thoroughly the mathematical correctness of the formula, experiments should have been made with the same pressure on columns of different lengths and shapes of cross-section, made of the same iron, of uniform quality, and all fittings made, and measurements taken, with great precision. All these conditions could not be realized. But for the objects in view—which were to ascertain whether the formula could be applied in practice with very approximately correct results, and, if so, to determine the correct value of the consonant f—scientific nicety was not necessary; it was preferable, on the contrary, that the conditions of the experiments should be the same as those actually met with in posts and struts as they stand in iron stauctures.

"The following general conclusions can be drawn from the examination and comparison of all the tests made on columns:

"1. For columns of the same shape, of different lengths, made of the same kind of iron, the values of f, calculated from the formulæ, do not differ more than can reasonably be accounted for by the ordinary want of uniformity in the quality of the iron, the differences not being greater than those between the ultimate tensile strengths, obtained with specimens of iron from the same manufacture.

"2. For columns of different shapes of cross-section, and made of different kinds of iron, the values of f calculated do not vary more than does the strength of iron of different manufactures.*

"3. Gordon's and Rankine's formulæ must both be considered as practically correct, for columns with flat bearings at the ends, of different lengths and shapes of cross-section, provided the ultimate strength of one column, made of the iron to be used, be determined, so that the value of the constant f to be applied in the formulæ may be calculated. This constant being very approximately proportional, but not equal to the ultimate strength of the iron, and not the same in the two formulæ, being smaller for Rankine's than for Gordon's.

"4. For columns hinged on pins at the ends, Gordon's and Rankine's formulæ for columns rounded at one end and fixed at the other will give approximately correct results, provided f be determined as noted above.

"5. For swelled columns, the formulæ are also applicable, provided the diameter at the end be used.

* Columns should be tested in a vertical, and not in a horizontal position as these were. But if tested horizontally, each column should be counterweighted with a weight equal to half its own weight, attached by a chain to the center, and passing over a pulley. This was done in all the columns but the Phœnix columns, and had they been counterbalanced they would have given considerably higher results than those attained.—T. C. C

"6. It is of great importance for all built columns, and especially for open columns, that the several parts should be well riveted at the ends, and that true and even bearings at the ends be obtained.

"In determining the sectional areas of the columns and struts for each structure, the foregoing conclusions were followed.

"Tests Nos. 6 and 12 confirmed the fact already pointed out by some experimenter, but not universally admitted, that wrought-iron, when submitted to a pressure beyond that corresponding to its limit of elasticity, and allowed to rest, will afterward possess a higher limit of elasticity.

"The singular results given by tests 18 and 19, in which both columns bent in the direction giving the greatest radius of gyration, which for No. 18 is perpendicular to the plane of rotation around the end pin, can be explained by defective fittings at the ends, inadequate balancing of the columns in the center, or insufficient riveting, allowing a slight longitudinal motion of the two channel bars in opposite directions."

(TO BE CONTINUED.)

NOTE.

A GAS LEAK DETECTOR.

Mr. G. F. Ansell, an Englishman, the inventor of the firedamp indicator, has recently applied the principle of that apparatus to the production of a handy little instrument for the detection of gas leaks. The action of Mr. Ansell's firedamp indicator is founded on the fact that different gases have different rates of diffusion through a porous body, the velocities of diffusion being inversely as the square roots of the respective densities of the gases. In the gas leak indicator this property is taken advantage of as follows: A small chamber is provided, having its back formed by a disk of terra cotta, this chamber being provided with a small stop-cock, by which its interior can be placed in communication with the outer air. If, when this stop-cock is closed, the indicator be taken into a room where a gas leakage exists, the gas, in virtue of the above-named law of diffusion, enters the chamber through the terra cotta disk more rapidly than the inclosed air escapes, and the pressure in the chamber consequently rises. This increase of pressure is utilized to move a hand on a dial at the front of the instrument, each pressure corresponding to a certain percentage of gas in the atmosphere in which the indicator is placed. The dial is graduated from 0 to 35 per cent. of gas, and is, moreover, marked to show when the mixture is and is not explosive. The instrument is very sensitive and prompt in its action, and it is calculated to serve a very useful purpose. The instrument is being introduced by Messrs. R. Macpherson & Co., of the Coal Exchange, London, Eng.

FOREIGN INTELLIGENCE.

A large number of new tramways are to be built in Japan.

An extra line of rails has been laid down between Tokio and Yokohama.

Most of the foreigners engaged on the railroad between Kobe and Otsu have been discharged on the completion of the contracts; only nine out of forty-six have been retained.

Messrs. Fujita, of Osaka, made 114,000 yen on a tunnel through Osakayama. The railroad company decided to make the other tunnels itself, and Fujita thereupon stopped work.

The town councillors of Musselburgh, Scotland, are not over-extravagant in their estimates of premiums for civil engineers' plans. They offer £15 15s., or some $78, for "the best and most effectual system and plans for the drainage of the burgh that can be devised."

The Boston company, represented at Guaymas, Mex., by Chief Engineer Morley and Supt. Gardiner, is making rapid progress on the railroad between Guaymas and Hermosillo, the capital of the State of Sonora. Fifty miles of grade are completed and 10 miles of rail laid from Guaymas. They have sufficient building material to carry on the work 60 miles farther. The company has just completed laying four miles and a half of four-inch iron pipe, by which it conveys water from a dug well to its machine shops, a feat never before accomplished in that country, as the population of Guaymas is supplied with water by water carts.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

Holyoke, Mass., proposes to build more water-works Several schemes have been proposed.

The City of Newport, R. I., will place 200 additional hydrants in position as a safeguard against fire.

NIAGARA FALLS, Jan. 17.—Early this morning the feeding pipe leading to the Clifton Water-works Company burst. The water washed away about twenty-five feet of the cliff to the south of table rock, besides doing other damage to property. Clifton, which has been for some time without the regular supply of water, owing to the river being so low as to render the water-works company unable to pump, is now shut of completely. The breakage, which is a very bad one, will take some time to repair.

The citizens of Boston are suffering from the presence of the "cucumber" taste in their water supply. Some very curious features are noticed in connection therewith, for instance, while the taste in some portions of the city renders the water unfit for drinking purposes, in other districts its presence cannot be discovered. The water is not affected in the sources of supply nor in the reservoirs, but the change appears to take place in the distributing mains. Chemistry and the microscope fail to find any cause for the trouble. The water was similarly affected in 1854 and 1875, but then the taste was observed in the reservoirs.

The report of City Engineer Cregier, of Chicago, shows that the average daily supply of water to that city is 58,000,000 gallons. From the 28th of December, and including the next nine days, there were pumped a daily average of 66,000,000 gallons. Friday, Dec. 31, the climax of the pumping period was reached, when 73,000,000 gallons were pumped in one day—45,000,000 by the North Division Pumping-works and 28,000,000 by the West Division. The increased consumption was an average of 13½ per cent. daily. On the basis of a population of 510,000 souls, the per capita use of water daily was 114 gallons, and during the coldest day, Dec. 31, 143 gallons.

ELECTRICITY.

The Gilbert car works at East Buffalo are to have the electric light.

The railway up the side of Mount Vesuvius is lighted by fourteen electric lights.

The metals which are found to longest retain heat are brass and copper; next, iron, and, lastly in order, lead.

The Franklin Electric Light Company of New York, capital $600,000, and the Long Island Electric Light Company, capital $300,000, have been incorporated.

Six companies—the Brush, Edison, Fuller, Jablochkoff, Maxim and Sawyer—compete for the privilege of lighting the "ways that are dark" in New York City, with electricity.

The principal streets of Liverpool are to be lighted with the electric light. The Council has just accepted a tender for a year at $12,000, which is double the price for gas with the same service.

AFRICAN TELEGRAPHY.—A project for constructing an electric telegraph from end to end of Africa has the sanction of the African Exploration Committee of the Royal Geographical Society. A report made to that society on the subject speaks in sanguine terms of its feasibility, with particulars of probable cost and revenue. The Egyptian Government at one end is prepared to carry forward its line, which already extends southward some distance beyond Khartoum, as far as Gondokoro. At the other end the government of the Cape Colony is expected to extend the existing line in British South Africa to Pretoria, in the Transvaal.

The Western Union Telegraph Company began in 1858 with the modest capital of $385,700. In the next eight years it had expanded to $22,000,000, of which $18,000,000 were stock dividends. The United States telegraph was bought with $7,216,800, said to be five times the value of the property acquired. For the American telegraph—stocked at $3,833,100—$11,833,100 in Western Union shares were issued, bringing the total capital up to $41,000,000 before a controlling interest in the Atlantic & Pacific was secured. All told, the consolidations and inflations of the Western Union only foot about $70,000,000, and this is to be brought up to $80,000,000 by $10,000,000 more of inflation.

STREETS, DRAINAGE, ETC.

The Governor of California will send in a special message on drainage.

Robert Moore, C.E., Sewer Commissioner of St. Louis, Mo., in a paper read before the American Public Health Association, at New Orleans, on "Storm Water and House Drainage in Sewers," sums up the whole matter in the following conclusions: 1. Sewers for storm water are needed in closely built towns to take the place of the natural water-courses which are obstructions to business and injurious to the public health. 2. Where the outfall of these sewers is into a tidal current, or a stream large enough to be beyond danger of pollution, it is cheapest and best to use the storm sewers for the reception of house drainage. 3. But where no such outfall can be obtained, the best method is complete separation, so that the storm water system shall receive no house drainage, and the house drainage system shall receive no storm water.

BRIDGES.

OTTAWA, Jan. 17.—The last stroke of work on the Chaudiere Bridge was completed several days ago, and to-day the first regular passenger train on the Quebec, Montreal, Ottawa & Occidental Railway passed over it.

The Northern Pacific Railroad Company has made arrangements for the immediate building of a bridge across the Missouri River between Bismarck and Mandan. The work will be in charge of Mr. George S. Morison, who was the engineer of the Plattsmouth bridge, completed last summer. The river at the bridge site was last year about a half-mile wide, but this width will be reduced by a system of dykes to less than 1,200 feet. The bridge will consist of three spans of 400 feet each, placed 50 feet above high water, with short spans in the approaches. The piers will be of granite from Minnesota. It is intended to have the bridge ready for use in the summer of 1882. Mr. H. W. Parkhurst, First Assistant Engineer, is now at Bismarck, making preparations for the work.

RAILROADS.

The International & Great Northern is now laying track beyond Cibolo, Tex.

The lawyers have decided that the trustees of the Cincinnati Southern Railroad have not the power to sell that road.

Preparations are being made at San Antonio, Tex., for the extension of the Sunset road. The contracts for grading will soon be let.

The route for the proposed railroad from Rochester to Braddock's Bay has been determined, and it is hoped a road can be ready for traffic in July.

The corps of surveyors employed by the Lake Erie & Western Railroad, to trace out an extension to St. Louis, have reached Shelbyville, Ill.

Twenty-five miles of the Delaware & Lackawanna's new road from Buffalo to Binghamton have been laid, leaving 200 miles more to be completed.

It is thought that the Missouri Pacific will connect with the International at Taylorsville, Tex., as it can be built for a third less money than to Georgetown.

The Canadian Pacific Railway syndicate on the 17th deposited $1,500,000 with the Receiver General at Toronto, as a guarantee of good faith in building the Pacific Railway.

The five bridges between Westchester county and this city, over the Bronx River, are in such a dilapidated condition that they are to be replaced by new ones similar to the one at Woodlawn.

The stockholders of the Valley Railroad met at Staunton, Va., on the 20th, and determined to put a mortgage of $700,000 on the road and complete it to Lexington, 36 miles south of Staunton.

The contract for the first section south of Fayetteville, Ark., on the Missouri, Arkansas & Southern Railway, an extension of the St. Louis & San Francisco Railway, was let to J. Devereaux on Saturday, the 15th.

In the Dominion Parliament, on the 17th, Sir John A. Macdonald, in a four hours' speech, stigmatized the proposed new Canadian syndicate for building the Pacific Railway as a political plot, without any honest financial purpose.

The Michigan Central Railroad Company has just awarded the contract for building the road-bed for a second track between Grass Lake and Chelsea. The distance is eleven miles, and work will be commenced in about ten days.

The surveying party of the International & Great Northern Railroad went into camp at San Antonio, Tex., on Jan. 10. They number about twenty men. They will go to Laredo, from which point a line will be run to the City of Mexico.

The use of iron sleepers is becoming general in Germany. The Berg-Mark Railway exchanges all the old, worn-out wooden sleepers for iron ones. Tenders were lately received by the Royal Prussian Railway Board for nearly 5,000 tons of iron sleepers.

The Missouri, Kansas & Texas Railway Company gives notice that at a special meeting of the stockholders, held Nov. 17, 1880, an increase of $25,000,000 in the capital stock was duly authorized, at a rate not to exceed $20,000 per mile for each mile of newly-constructed or acquired road.

The Green Bay & Minnesota Railroad was sold by United States Marshal Fink at Milwaukee, on the 20th, to J. J. Blair, of New Jersey, for $2,000,0000. The interest now due is $1,051,002 on first and $289,088 on second bonds. The total bonded debt is $5,585,350. The company now operates 219 miles of road.

The president of the Baltimore & Delta narrow-gauge reports the road nearly ready for the superstructure. The directors have adopted measures looking to the early placing of the first-mortgage bonds of the company upon the market for the purpose of raising necessary funds to complete and equip the entire road of 44 miles in length.

Work was begun Jan. 17 on the Red Stone branch of the Pittsburgh, Virginia & Charleston Railroad, extending from Brownsville to Uniontown. It connects with the Southwest Railroad at Hoggsett's Cut, one mile below Uniontown, and with the Pittsburgh, Virginia & Charleston road by a bridge over the Monongahela River, near Brownsville.

A special dispatch from Steubenville, O., announces that a subscription of about $4,000 has been made by some of the business men of that city, to be used in making the surveys and plans of a road twenty-seven miles to Carrollton. From an inspection of the proposed location, it is stated that the road can be completed and equipped for $250,000.

The stockholders of the Ontario and Western Railway Co. elected the following directors on the 19th: Chas. F. Woerishoffer, Horace Porter, E. F. Winslow, Jacob H.

Schiff, Henry Amy, Wm. Adams, Jr., Thomas C. Clarke, Fred. Butterfield, Conrad N. Gordon, E. E. Chase, Chas. J. Canda, Wm. H. Fenner and Theo. Houston. It was announced that the Batavia was taking out 50,000 shares of the stock to the European market. At a session of the new Board of Directors General Winslow, who is President of the St. Louis & San Francisco Railroad Company, was chosen President, and C. N. Jordan as Secretary.

The Paris, Lyons & Mediterranean Railway Company has just ordered 130 new locomotives, making a total of 2,089 in use on that railway. The Northern of France Railway Company has ordered 416 locomotives during the past year, and now have ordered 60 more. Of this number only 10 engines can be turned out by French works. The balance were contracted for in Austria. Contracts have just been let for 20,000 tons of steel rails for the French State railways. The St. Gothard Railroad Company have not yet accepted tenders for 37 engines advertised for some time ago.

The rail mills are crowded with orders for next year's consumption, and are likely to have all that they can do, although several new mills will be in operation. Mr. Swank estimates the production of rails of all kinds in the United States in 1880 at 1,200,000 gross tons; in 1879 it was 993,993 tons. Of the production of 1880 there were 775,000 tons of steel rails and 425,000 tons of iron rails; in 1879 we produced 610,682 gross tons of steel rails and 183,311 tons iron rails. During 1880 we imported about 275,000 tons of rails of all kinds, which, added to the probable production of 1,200,000 tons, gives 1,475,000 tons as the approximate consumption of the year.

Railroad building, as everyone knows, is now pushed far in advance of population, but very few understand how far. New England has 1¼ miles of road to every 1,000 of population, the Middle States 1¼ miles, and in general this is the proportion on the Atlantic Coast. The territories, which have added in 1880 two-thirds to their total mileage at the close of 1879, have now over 5 miles of road to every 1,000 of population; the Pacific States, which have added 10 per cent. to their mileage, 3 miles to every 1,000; and the states in the new Northwest, with an addition in 1880 of an eighth to their mileage, have now nearly 4 miles to every 1,000 of population. A country which is absorbing 500,000 yearly in immigration, and nearly 1,000,000 more by natural increase, can afford to lay track ahead of settlement; but if railroad building goes on at the present rate, there is a time not far ahead when track-laying will have to wait for population to catch up.—*Springfield Republican.*

HOW RAILWAY TIME IS KEPT.—There are in use between Albany and New York 13 electric clocks, two of the number being placed in the waiting-rooms, and one in the dispatcher's office at the Grand Central Depot, New York. The time on the clock in the depot at East Albany corresponds exactly with the time in New York. Each one of the clocks is connected with the general superintendent's office in New York, in which the railroad time is kept on what is called the "big clock." Conductors, train men and others are compelled to keep their watches in strict conformity with the superintendent's clock. It is set by standard time, and connected with the time service department of the gold and stock telegraph. The time is distributed all over the line each week day as follows: At 10 o'clock 58 minutes and three seconds A. M., the word "time" is sent by the main office to the telegraph stations between New York and Albany. This word is repeated for 28 seconds, during which time operators must see that their instruments are adjusted. At 10 o'clock and 50 seconds, seconds commence beating, and continue for 50 seconds. The word "switch" is then sent over the wire, and operators having having electric clocks connect them immediately with the circuit known as No. 9 wire. Ten seconds are allowed in which to make the connection. At 11 A. M., with one touch of the New York key, the hands on the different clocks are set to 11 o'clock.

RIVERS AND HARBORS.

The smaller towns along the Illinois River are complaining of the pollution of the stream by Chicago sewers.

The committee of Galveston citizens, who were to report on deep water, has called a general meeting on the subject.

A bill has been introduced in the Illinois Legislature to cede the Illinois & Michigan Canal and the improvements on the Illinois River to the United States, on condition that the National Government agree to convert them into a water course for ships.

WASHINGTON, Jan. 17.—The item of $150,000 which the Committee on Commerce have agreed to allow for the continuation of work on the Davis Island Dam, while it will not enable the engineers to push the work with the rapidity they desire, it will be sufficient to purchase material. It is now proposed by the engineers to contract for all the material necessary to complete the work and get that on hand instead of dragging along, and then finish up at once.

The report that the Boston Cape Cod ship canal company has employed anyone to re-survey a line for them is denied by its president.

NEW PROJECTS.

The St. Johnsbury & Lake Champlain Railroad is to be extended from Swanton, Vt., to Rouse's Point, N. Y., this coming summer.

The contractors of the Toledo, Delphos & Burlington narrow-gauge railroad have completed the road from Marion (Ind.) to Toledo.

A stock company is being formed for the purpose of laying a wooden pipe between East Tawas and Oscoda, Mich., for conveying brine between the two places.

At Ashtabula, O., Wallace McGrath, of Columbus, with ten assistants, is making a preliminary survey for Jay Gould's new railroad from New York to Chicago.

HAMILTON, Ont., Jan. 18.—Messrs. E. & C. Gurney, stove manufacturers, have joined the New Canadian Pacific Railway syndicate, and added $1,000,000 to the capital.

It is reported that the Gulf, Colorado & Santa Fe Railroad Company has let out the contract for grading an addicional 40 miles west of Belton, Texas, making 70 miles in all.

The New Produce Exchange Building in this city is to be located on Broadway and Whitehall street; will cost between $600,000 and $900,000; is to be commenced May 1, next, and completed within the year.

A syndicate has been formed for the purpose of leasing the government railways between Quebec and Ottawa, and it is anticipated that the Quebec House will will be summoned at an early day to ratify the lease.

The Executive Committee of the World's Fair Commission has informally decided to call a mass-meeting, at which General Grant will preside, for the purpose of increasing the general interest in the work, but the time and place have not yet been fixed.

A dispatch from Marion (Ohio), states that the subscriptions for the construction of a new road to that city have now been seconded by the directors of the Chicago & Atlanta, and that work will begin on the road bed as soon as the weather will permt.

A corps of surveyors, under the direction of Chief Engineer Appleton, reached Schenectady last week and started up the valley of the Mohawk on the south side. The object in view is the practicability of building a road through the Mohawk Valley to the western part of the State of New York, to make connection with the Lake Shore.

A company has been organized at Green Bay under the name of the Wisconsin Peninsula Railroad Company. The object is to build a narrow-gauge road from Green Bay to the northern extremity of Door County, a distance of 80 miles. The surveyors are already at work. The road will be important in developing mining districts.

An Ottawa despach says the following deposits were made with the Government on the 17th by the new syndicate: Mr. Gusson, $500,000; Toronto members, $500,000; Mr. McLaren, $100,000; Mr. Carruthers, $100,000; Mr. Gilmour, $100,000; Messrs. Lovett, $50,000. Total, $1,950,000. Messrs. Barnett & McKay yesterday deposited $20,000 on account of the new syndicate. The deposits with the Canadian Government in behalf of the road up to this time amount to $1,400,000.

Articles of association of the Mitchel, French Licks and Dubois Railroad were filed with the Secretary of State at Indianapolis, on the 18th. The capital stock is $1,000,000, divided into 20,000 shares. The road will run from Mitchel, Ind., at the intersection of the Ohio and Mississippi and L., N. and C. railroads, in a southwestern direction through Lawrence and Orange counties to the town of Jasper, in Dubois county. The directors are William Howard Irwin, J. C. Butler, C. Barfield, F. E. Clarkson, Charles E. Davis, W. H. Mummell.

A Valparaiso (Ind.) dispatch of Jan. 16 says: "Assistant Engineer B. P. Griffith arrived here last evening for the purpose of surveying a route for the Chicago & Atlantic Railroad. Mr. Griffith states that this route will be first-class steel rails all the way, that they are already bought and partly shipped. The Chicago & Atlantic will connect at Marion, O., with the New York, Pennsylvania & Ohio, forming a trunk line between New York and Chicago. The contract calls for the completion of the 273 miles between Chicago and Marion inside of two years. Mr. Girffith states that they expect to enter Chicago over the Western Indiana track, tapping that corporation at Dalton."

There is no longer any doubt that the section now known in a general way as South Chicago will at some day not very far distant be one of the largest manufacturing districts in the world. The location of the vast car-works to be managed by the Pullman Car Company, and the construction of the town of Pullman, now springing up like magic on the west shore of Calumet Lake, have assured this future to South Chicago, which, in a general way, is meant to include the southerly portion of Hyde Park Township. The city now in progress of construction under the auspices of the Pullman Company will probably be the most complete manufacturing settlement on this continent. It will be provided with vast shops, model houses, gas, water, pleasure grounds, and all the accessories of comfortable modern existence, and will have a population of 10,000 people within a year. It will have a railroad of its own connecting with the belt railroad, and so with all the other railroads that center in Chicago. A canal is to be constructed across Lake Calumet, connecting with the Calumet River, and thus bringing navigation up to Pullman. In addition to the car-works now building, vast locomotive-works will be erected under the partial auspices of the same company, and will be located in the same neighborhood. These will attract other manufacturing interests. Indeed, applications for land to be used in that way have already been made, and the new improvements, in addition to the large works already in operation, such as the Potter Rolling-Mill and the Brown Iron-Works, and the great nail factory, will make this section within a few years the busiest and most enterprising of all American manufacturing centers. The future growth of this portion of Chicago, as it may properly be regarded, is assured beyond all peradventure except universal panic, plague or famine.

THE MARKET.

OFFICE OF ENGINEERING NEWS,
Friday Morning, Jan. 21, 1881.

IRON RAILS.—No transactions of any magnitude have occurred in this market since our last report. Prices remain at $46@$49.

STEEL RAILS.—The demand for steel rails is very active, and several large contracts are pending. Sales of American Steel aggregating 20,000 tons are reported, but the terms have not been made public. We quote $57.50@$62.50 at mill.

OLD RAILS.—During the past two weeks, the transactions in this line have been unusually heavy, and prices have ranged at from $1 to $2 above the figures which would have been accepted a few days since. We quote: Tees $29, and Double Heads $31. Should the demand continue, these prices will not hold more than a few days.

PIG IRON.—The tone of the market is firm, with business of considerable magnitude transpiring. We quote: Foundry No. 1, $25; Foundry No. 2, 22; Gray Forge, $20@$21.

SCOTCH PIG.—Owing to an advance in ocean freights, and because of the firm tone of the English market, holders ask from 50 cents to $1 advance of our last quotations. Prices are: Eglinton, $22@$22.50; Carnbroe, $22.50; Coltness, $24.50@$25; Glengarnock and Gartsherrie, $23.50@$24.

STEEL.—We quote as follows:

American Tool, ℔ ...	12	@	13
American Machine	6¾	@	7
American Bessemer	6	@	6¼
Bessemer Tires	5	@	5¼
English Tool	14½	@	15

MANUFACTURED IRON.—Prices have not changed materially since our last report: Bars, 2.25c.; Sheet Iron, 3.70@3.75c. for No. 24; Skelp, 2.20@2 30c.; Tank, 2.90@3c.; Hoop, 3@3.10c.

SHEET IRON continues quiet and largely nominal, owing to the between season period. Quotations are as follows:

Russia per pound	12	@	....
American common singles	3¾	@	4
American common doubles	4¼	@	4½
American refined	5½	@	5¾
Galvanized, Nos. 14 to 20	7½	@	....
Nos. 21 to 28	8½	@	11½

WROUGHT-IRON.—No change since our last report. Boiler Tubes remain at 40 off. Oil-Well Casing and Tubing, 21c. and 70c. per foot, net.

CEMENT.—This market is still firm at the following prices:

Rosendale ℔ bbl	$1.15	@	1.25
Portland, Saylor's American	2.25	@	2.50
Portland (English)	2.65	@	3.40
Portland Lafarge	3.20	@	3.00
Portland K. B. & S.	2.90	@	3 00
Portland Burham	2.65	@	....
Lime of Teil	2.20	@	2.30
Lime of Teil ℔ ton	15.00	@	18.00
Roman ℔ bbl	2.75	@	3.25
Keene & Martin's Coarse	6.00	@	6.50
Keene & Martin's Fine	10.50	@	....

LIME.—The demand is good, supplies being taken as soon as received; prices remain unchanged as follows:

Rockland common ℔ bbl	$0.90	@	....
Rockland finishing	1.00	@	....
State, common, cargo rate ℔ bbl	.90	@	....
State finishing	1.15	@	....
Ground	.95	@	1.00

Add 25c. to above figures for yard rates.

BRICK.—The following are the current cargo prices for brick.

Pale, per M	$3.50	@	....
Haverstraw Bay, 2ds	7.50	@	7.75
Haverstraw Bay, 1sts	8.00	@	....
Favorite brands	8.25	@	....
Hollow fire clay brick	9.00	@	9.25
Fronts:			
Croton and Croton Points, ℔ M	$10.50	@	$11.00
Philadelphia	....	@	....
Trenton	21.00	@	22.00
Baltimore	38.00	@	....

Yard prices 50c. per M. higher, or, with delivery added, $2 per M. for Hard and $3 per M. for Front Brick. For delivery add $5 on Philadelphia and Trenton and $6 on Baltimore.